

Claims

1. A heel effect compensation filter

which is configured to have a thickness distribution that
uniforms an X-ray intensity angular distribution that is
5 nonuniform in a body axis direction of a subject in an X-ray flux
irradiated space,

the space being formed by an X-ray flux diverging from an
anode in a body width direction of the subject and diverging in
a shape of an approximate sector in the body axis direction
10 orthogonal to the body width direction due to the X-ray intensity
angular distribution affected by a heel effect, when the X-ray
flux generated on the anode by irradiating a thermoelectron beam
flux from a cathode to the anode is irradiated on the subject
through a wedge filter configured to have a cylindrical concave
15 surface with a curve being formed in the body width direction of
the subject, wherein

the thickness distribution is defined by Formula 1:

$$\begin{pmatrix} y' \\ z' \end{pmatrix} = \begin{pmatrix} L(\theta) \cos \theta \\ \frac{FFD}{FCD} (FCD \tan \theta - L(\theta) \sin \theta) \end{pmatrix} \quad (\text{Formula 1})$$

$$20 \quad (\theta \leq |\text{cone angle}|)$$

where, on a plane containing an irradiation axis of the X-ray flux
and a beam irradiation axis of the thermoelectron beam flux, the
irradiation axis of the X-ray flux is defined as a Y-axis, and

an axis orthogonal to the Y-axis at a distance FCD along the Y-axis in a direction of X-ray flux irradiation is defined as a Z-axis; z' and y' represent positions in corresponding axial directions with the proviso that an intersection point of the Z-axis and the Y-axis is defined as an origin point; FFD is defined as a
5 predetermined distance along the Y-axis from a position of the anode; θ is defined as a predetermined angle within a range of a cone angle symmetrically diverging from the position of the anode relative to the irradiation axis of the X-ray flux; and
10 $La(\theta)$ is defined as a length in a y' direction at the angle θ .

2. The heel effect compensation filter according to Claim 1, wherein the heel effect compensation filter is separable into pieces and a distance in the heel effect compensation filter
15 through which the X-ray flux transmits during usage is equal to the thickness distribution.

3. The heel effect compensation filter according to Claim 1 or 2, wherein either of an X-ray flux-incoming side transmissive
20 surface and an X-ray flux-outgoing side transmissive surface is configured as a cylindrical convex surface with a curve being formed in the body axis direction of the subject and the other is configured as a flat surface.

25 4. The heel effect compensation filter according to Claim 1 or 2, wherein either of an X-ray flux-incoming side transmissive

surface and an X-ray flux-outgoing side transmissive surface is configured as a cylindrical convex surface with a curve being formed in the body axis direction and the other is configured as a cylindrical concave surface with a curve being formed in the body width direction orthogonal to the body axis direction.

5. The heel effect compensation filter according to any one of Claims 1 - 4, which is employed in an X-ray CT scanner having 32 arrays or more of X-ray detectors.

6. An X-ray irradiator in which a thermoelectron beam flux is irradiated from a cathode to an anode and an X-ray flux generated on the anode is irradiated on a subject, wherein

the heel effect compensation filter according to any one of Claims 1 - 5 is disposed between the anode and the subject at a predetermined distance,

the filter being configured to adjust the X-ray intensity angular distribution of the X-ray flux to become uniform that is nonuniform in a body axis direction of the subject in an X-ray flux irradiated space,

the space being formed by the X-ray flux diverging from the anode in a body width direction of the subject and diverging in a shape of an approximate sector in the body axis direction orthogonal to the body width direction due to the heel effect.

7. An X-ray CT scanner in which the X-ray irradiator according

to Claim 6 is employed.

8. A method for X-ray CT imaging which reduces an artifact of image data obtained by an X-ray CT scanner by employing the heel
5 effect compensation filter according to any one of Claims 1 - 5 in the X-ray CT scanner and reducing a difference in CT value of the image data obtained along a body axis direction.